Claims

1. A gas sampling system, comprising:

a plurality of diluters arranged in a serial array along an axial extent;

a source of dilution air fluidically connected to each one of said plurality of serially arranged diluters so as to supply dilution air into each one of said plurality of serially arranged diluters such that said dilution air is supplied into said gas stream present within each one of said plurality of serially arranged diluters so as to progressively dilute said gas stream as said gas stream flows through said plurality of serially arranged diluters; and

sampling apparatus fluidically connected to each one of said plurality of serially arranged diluters for obtaining and analyzing a sample of said diluted gas stream present within each one of said plurality of serially arranged diluters.

2. The system as set forth in claim 1 wherein said sampling apparatus includes a scanning mobility particle sizer.

3. The system as set forth in claim 1 wherein said sampling apparatus includes a condensation particle counter.

4. The system as set forth in claim 1 including a plurality of diluent mass flow controllers (DMFCs) disposed fluidically upstream of said

plurality of serially arranged diluters for monitoring the mass flow of dilution air being supplied to said plurality of serially arranged diluters, and at least one total mass flow controller (TMFC) disposed fluidically downstream of said plurality of serially arranged diluters for monitoring the mass flow of diluted air stream flowing through said plurality of serially arranged diluters.

5. The system as set forth in claim 4 wherein said at least on total mass flow controller (TMFC) includes a plurality of total mass flow controllers (TMFCs) fluidically connected respectively to each one of said plurality of serially arranged diluters.

6. The system as set forth in claim 5 wherein each one of said plurality of total mass flow controllers (TMFCs) is operatively associated with a respective one of said diluent mass flow controllers (DMFCs) such that said diluent mass flow controllers (DMFCs) and said total mass flow controllers (TMFCs) are arranged in operative pairs.

7. The system as set forth in claim 6 including a calibration valves fluidically connected to each one of said diluent mass flow controllers (DMFCs) and fluidically connected to each one of said total mass flow controllers (TMFCs) so as to permit calibration of each one of said diluent mass flow controllers (DMFCs) with respect to its paired total mass flow controller (TMFC).

8. The system as set forth in claim 4 wherein each one of said plurality of diluent mass flow controllers (DMFCs) is fluidically connected directly to a respective one of said plurality of serially arranged diluters.

9. The system as set forth in claim 4 wherein an air dilution manifold is disposed fluidically upstream of said plurality of serially arranged diluters, and said plurality of diluent mass flow controllers are fluidically connected to said air dilution manifold so as to supply diluent air to said plurality of serially arranged diluters through said air dilution manifold.

10. The system as set forth in claim 4 including a plurality of calibration valves fluidically connected to each one of said plurality of diluent mass flow controllers (DMFCs) so as to permit calibration of each one of said diluent mass flow controllers (DMFCs) with respect each other.

11. The system as set forth in claim 4 including a plurality of calibration valves fluidically connected to each one of said plurality of diluent mass flow controllers (DMFCs) so as to permit calibration of each one of said plurality of diluent mass flow controllers (DMFCs) with respect to each other and with respect to said at least one total mass flow controller (TMFC).

12. The system as set forth in claim 11 including a calibration control valve fluidically interposed said plurality of calibration valves and said at least one total mass flow controller (TMFC) for selectively permitting calibration of a particular one of said plurality of diluent mass flow controllers (DMFCs) with respect to said at least one total mass flow controller (TMFC).

13. An exhaust gas sampling system for use in connection with the sampling of internal combustion engine exhaust gas streams, comprising:

a plurality of diluters arranged in a serial array along an axial extent;

a source of engine exhaust gas fluidically connected to said plurality of serially arranged diluters so as to supply an engine exhaust gas stream into each one of said plurality of serially arranged diluters in a serial manner;

a source of dilution air fluidically connected to each one of said plurality of serially arranged diluters so as to supply dilution air into each one of said plurality of serially arranged diluters such that said dilution air is supplied into said engine exhaust gas stream present within each one of said plurality of serially arranged diluters so as to progressively dilute said engine exhaust gas stream as said engine exhaust gas stream flows through said plurality of serially arranged diluters and thereby replicate engine exhaust gas stream pollutant atmospheric conditions; and a sampling apparatus fluidically connected to each one of said plurality of

serially arranged diluters for obtaining and analyzing a sample of said diluted engine exhaust gas stream present within each one of said plurality of serially arranged diluters.

14. The system as set forth in claim 13 wherein said sampling apparatus has a scanning mobility particle sizer.

15. The system as set forth in claim 13 wherein said sampling apparatus has a condensation particle counter.

16. The system as set forth in claim 13 including a plurality of diluent mass flow controllers (DMFCs) disposed fluidically upstream of said plurality of serially arranged diluters for monitoring the mass flow of dilution air being supplied to said plurality of serially arranged diluters, and at least one total mass flow controller (TMFC) disposed fluidically downstream of said plurality of serially arranged diluters for monitoring the mass flow of the diluted air stream flowing through said plurality of serially arranged diluters.

17. The system as set forth in claim 16 wherein said at least one total mass flow controller (TMFC) includes a plurality of total mass flow controllers (TMFCs) fluidically connected respectively to each one of said plurality of serially arranged diluters.

18. The system as set forth in claim 17 wherein each one of said plurality of total mass flow controllers (TMFCs) is operatively associated with a respective one of said diluent mass flow controllers (DMFCs) such that said diluent mass flow controllers (TMFCs) are arranged in operative pairs.

19. The system as set forth in claim 18 including a calibration valves fluidically connected to each one of said diluent mass flow controllers (DMFCs) and fluidically connected to each one of said total mass flow controllers (TMFCs) so as to permit calibration of each one of said diluent mass flow controllers (DMFCs) with respect to its paired total mass flow controller (TMFC).

20. The system as set forth in claim 16 wherein each one of said plurality of diluent mass flow controllers (DMFCs) is fluidically connected directly to a respective one of said plurality of serially arranged diluters.

21. The system as set forth in claim 16 including an air dilution manifold disposed fluidically upstream of said plurality of serially arranged diluters, and said plurality of diluent mass flow controllers are fluidically connected to said air dilution manifold so as to supply diluent air to said plurality of serially arranged diluters through said air dilution manifold.

22. The system as set forth in claim 16 including a plurality of calibration valves fluidically connected to each one of said plurality of diluent mass flow controllers (DMFCs) so as to permit calibration of each one of said diluent mass flow controllers (DMFCs) with respect to each other.

23. The system as set forth in claim 16 including a plurality of calibration valves fluidically connected to each one of said plurality of diluent mass flow controllers (DMFCs) so as to permit calibration of each one of said plurality of diluent mass flow controllers (DMFCs) with respect to each other and with respect to said at least one total mass flow controller (TMFC).

24. The system as set forth in claim 23 including a calibration control valve fluidically interposed said plurality of calibration valves and said at least one total mass flow controller (TMFC) for selectively permitting calibration of a particular one of said plurality of diluent mass flow controllers (DMFCs) with respect to said at least one total mass flow controller (TMFC).

25. A method of sampling an exhaust gas from an internal combustion engine, comprising the steps of:

positioning a plurality of diluters in a serial array along on axial extent;

connecting a source of gas fluidically to said plurality of diluters supplying a gas stream into each one of said plurality of diluters;

supplying a source of a dilution air to each one of said plurality of diluters, said supply of dilution air progressively diluting said gas stream as said gas stream flows through said plurality of diluters; and

sampling said gas stream at each one of said plurality of diluters.